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PHYTOPLANKTON SHOW THE POLLUTION STATUS OF A POND

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ABSTRACT

A study of phytoplankton composition of a pond shows the pollution scenario of a particular water body. Members of Cyanophyceae dominate but Chlorophyceae were very few in number. Shannon-Weaver species diversity index value (2.201-2.419) indicates light to moderate pollution status.

INTRODUCTION

Phytoplankton are autotrophic in nature and the primary producers in aquatic habitats. The pond in the present study partly surrounded by trees and partly by nearby houses was connected with the drainage system of the surrounding houses. This specific investigation was undertaken to study phytoplankton assemblage and its use in a biomonitoring system to check the pollution status. After proper enumeration of the phytoplankton composition, it will be also possible to compare these data with other lentic water bodies of the area to know the phytoplankton diversity, their composition and further establishment of a proper pollution indication system.

MATERIALS AND METHODS

Field collections were done in March, July and November to observe the species diversity and plankton density of the pond for pre-monsoon, monsoon and post-monsoon seasons. Water samples were collected in 400 ml amber-colored bottles and preserved in Lugol's iodine, which speeds up the sedimentation process as it also preserves the fragile structure. Sometimes REMI centrifuge was used for faster sedimentation. pH and water temperature were recorded at the time of collection (Table 1). Each collection was made between 9 and 10 am to get the best representation of phytoplankton. Usually the plankton density is calculated by the micro transect method (Lackey, 1938; Edmondson, 1974). The plankton density was calculated as follows.

Lugol's iodine was added in 100:1 ratio and allowed the sample to stand overnight or more to concentrate the sample perfectly. The supernatant part of the water was pipetted out and the samples were concentrated to 4 ml. From such concentrated sample three drops were examined for each season. Amber colored bottles were used to prevent the discoloration of algae. An important factor which helps to prove this method is that as higher volume of sample may be investigated in comparison to the Utermohl's original

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procedure (Utermohl, 1931). In general, the established method of counting of phytoplankton is done by using Sedgewick-Rafter counting cell at 100 magnification (Sedgwick, 1988). Here phytoplankton were counted as follows: A drop of concentrated sample was put on a slide, which is equivalent to 0.1 ml of the concentrate, put a cover glass on it and thoroughly scanned the slide at least five times under Olympus GB microscope. Three drops of sample from the same concentrated material was checked. So in this method it is possible to incorporate more data and finally accepting the average value, which provides less error.

The Shannon formula (Odum, 1969) was used for the determination of phytoplankton diversity.

$$H = \sum_{i=1}^{s} {}^{ni}/_{N} \log_2 {}^{ni}/_{N}$$

Here, 'N' denotes the total number of individuals per litre, 's' is the species number; 'ni' is the number of individuals of each species; 'H' is represented into an approximate value which combines variety and diversity into a particular numerical expression. Identification of the phytoplankton was done using standard literature (Smith, 1950; Prescott, 1962, 1978; Ling & Tyler, 1986).

RESULTS AND DISCUSSION

Phytoplankton are very useful tools for the biomonitoring of a water body with regard to its pollution status (Stoermer, 1977). Under the present investigation a lentic water body was selected just opposite of Bally railway station where collections were made season-wise. The percentage of the phytoplankton composition throughout the year shows that members of Cyanophyceae dominate (55%, 44.44% & 46.67%) and Chlorophyceae were least (5%, 11.11% & 13.33%) for pre-monsoon, monsoon and post-monsoon seasons, respectively (Table 2). Phytoplankton calendar for the three seasons shows the presence and absence of all the collected phytoplankton (Table 3).

Phytoplankton density and species diversity values were maximum in pre-monsoon season (Table 1). The species diversity ranged between 2.201 to 2.419 and according to Wilhm & Dorris (1966) the particular pond shows moderate pollution status. Wilhm & Dorris (1966) have proposed the specific relationship between species diversity and pollution status of a water body as, species diversity value > 3=clean; 1.3=moderately polluted and < 1-heavily polluted. Staub et al. (1970) proposed another scale of pollution in terms of species diversity

Table 1. Collection details with water temperature, pH, phytoplankton density/litre and Shannon Weaver species diversity index value.

Season and collection date	pH	Water body (°C)	Phytoplankton density/litre	Species diversity value
Pre-monsoon 5th March, 2009	6.8-6.9	26-28	15438	2.419
Monsoon 5th July, 2009	6.5-6.6	31-32.5	8758	2.315
Post-monsoon 5th November, 2009	6.8-7	27-28.5	7760	2.201

Table 2. Percentage composition of phytoplankton.

Phytoplankton	Pre-monsoon	Monsoon	Post-monsoon
Cyanophyceae	55	44.44	46.67
Euglenophyceae	15	16.67	6.67
Dinophyceae	15	11.11	13.33
Bacillariophyceae	10	16.67	20
Chlorophyceae	5	11.11	13.33

Table 3. Enumeration of phytoplankton occurring at the study site throughout the year under pre-monsoon, monsoon and post-monsoon seasons.

Algal taxa	Pre-monsoon	Monsoon	Post-monsoon
Oscillatoria sp.	+	+	+
Chroococcus sp.	+	+	-
Aphanocapsa sp.	+	-	+
Polycysits sp.	+	+	+
Aphanothece sp.	+	+	+
Merismopedia sp.	+	+	+
Coelosphaerium sp.	+	+	-
Myxosarcina sp.	+	-	+
Stichosiphon sp.	+	-	-
Lyngbya sp.	+	+	+
Aphanizomenon sp.	+	+	-
Euglena sp.	+	+	+
Phacus sp.	+	+	-
Lepocinclis sp.	+	+	-
Ceratium sp.	+	-	-
Glenodinium sp.	+	+	+
Peridinium sp.	+	+	+
Nitzschia sp.	+	+	+
Navicula sp.	-	+	+
Synedra sp.	+	+	+
Scenedesmus sp.	+	+	+
Cosmarium sp.	-	+	+

+=present, -=absent.

which is different from that of Wilhm & Dorris (1966) as follows:

Species diversity value 3.5-4.5=slight pollution; 2.0-3.0=light pollution; 1.0-2.0=moderate pollution and 0.0-1.0=heavy pollution.

According to Staub et al. (1970) the present water body shows light pollution status. Cyanophyceae which dominates has species of *Oscillatoria, Merismopedia, Lyngbya, Aphanizomenon* and *Coelosphaerium*. Among Dinophyceae *Peridinium* sp. was mostly present throughout the year. The Euglenophycean and Dinophycean representatives which prefer polluted conditions also support the pollution level of this particular pond. Members of Chlorophyceae which generally prefer clean water were very few. The present findings indicate that the water quality of the pond under consideration is not suitable for drinking and domestic use. Proper scientific planning is needed to use this pond water effectively.

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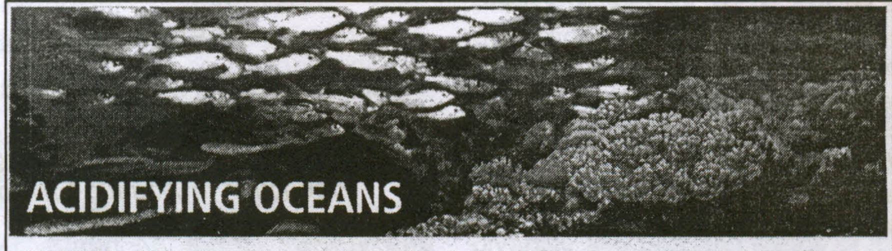

ONGOING acidification of the Earth's oceans may impair the ability of some marine organisms to make their calcium carbonate skeletons. According to a recent study in *Nature Geoscience*, the impacts of the current phase of acidification are likely to be more severe than those associated with a similar event that occurred some 55 million years ago, at the Palaeocene-Eocene boundary.

Andy Ridgwell and Daniela Schmidt of the University of Bristol, United Kingdom simulated and compared the response of the ocean to increased acidification in the future and at the Palaeocene-Eocene boundary. Assuming that atmospheric carbon dioxide concentrations will peak around the year 2150, they found that conditions favourable for the formation of calcium carbonate (calcite) skeletons become on average restricted to the upper-most 600 m of the ocean – as opposed to 4 km for the modern ocean. This change in ocean conditions occurs far more rapidly than estimated for the Palaeocene-Eocene boundary.

Marine organisms residing in the deep-sea sediment – also called benthic organisms – were particularly affected at the Palaeocene-Eocene boundary, leading to extinction. This has the potential to recur if the modern phase of acidification continues. Not only that, but the capacity of surface-dwelling micro-organisms to adapt to such changes will also be severely tested, say the researchers.

Ridgwell A, Schmidt D (2010), *Nature Geoscience* DOI: 10.1038/NGEO755.

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